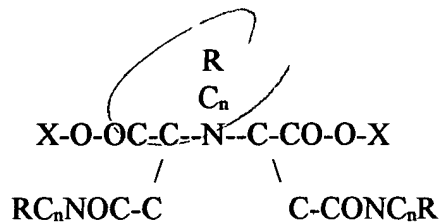


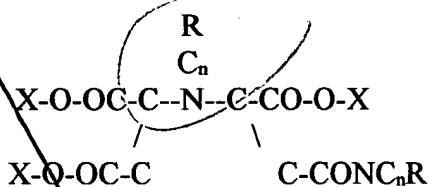
## I CLAIM:

1. A chelating composition comprising a modified iminodisuccinic acid, or a salt thereof, having one or more of the following formulas:

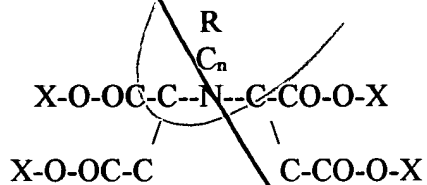
(a)



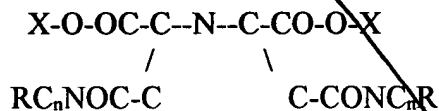
(b)



(c)



(d)

Sub  
1018

5

1, 6-11, 15, 19, 23, 27, 31, 33

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31: 101

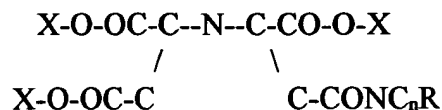
33: 112  
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20

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Spec.  
page 3, line 18

5 (e)



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where X may be H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal;

where n may be 1 to 10; and

15 where R may be a Lewis base capable of donating a nonbonded pair of electrons.

2. The chelating composition of claim 1 in combination with fertilizer or fertilizer additives.

20 3. A fertilizer comprising the chelating composition of claim 1 for application to soils, seeds or plants

4. The fertilizer of claim 3 wherein said fertilizer is a non-phosphate fertilizer.

5. The fertilizer of claim 3 wherein said fertilizer is a phosphorus containing fertilizer.

25 6. A method for making a modified iminodisuccinic acid comprising:

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112, 224  
6, 8, 9, 11, 15, 19

505  
C2

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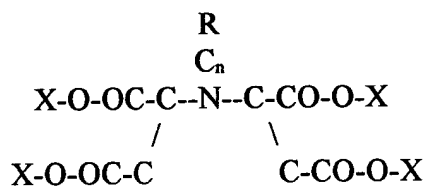
$$\begin{array}{c} \text{R} \\ \text{C}_n \\ \text{X-O-OC-C-N-C-CO-O-X} \\ | \qquad \qquad | \\ \text{RC}_n\text{NOC-C} \qquad \text{C-CONC}_n\text{R} \end{array}$$

(b)



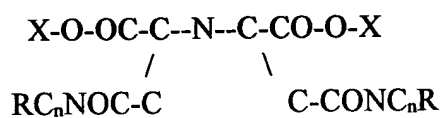
(c)

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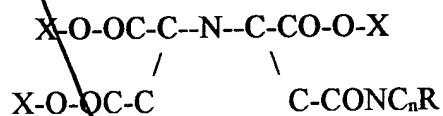
(d)

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(e)

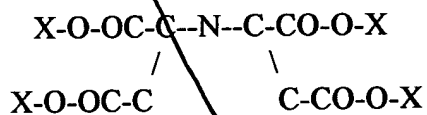
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(f)

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where X may be H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal;

where n may be 1 to 10; and

30 where R may be a Lewis base capable of donating a nonbonded pair of electrons.

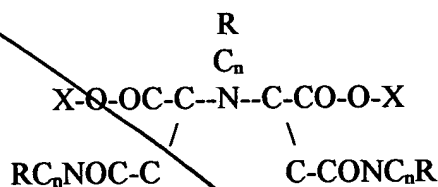
8. The method of claim 6 wherein said anhydride is maleic anhydride and said first

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polyfunctional amine is ethanol amine and said second polyfunctional amine is  $\text{NH}_3$  and said iminodisuccinic acid is comprised of 2, 2-amino N,N-diethanolsuccinic amide.

9. The method of claim 6 where, instead of adding to the amide a second polyfunctional amine, an acid anhydride and  $\text{Me}(\text{OH})$  and  $\text{R-NH}_2$ , where R is hydroxyl, is added to the amide and allowed to react to form an amino acid Me salt of the amide, which in said water will become a modified iminodisuccinic acid.
10. The method of claim 6 wherein said anhydride or lactone is selected from the group consisting of: maleic anhydride; and said first and second polyfunctional amines are selected from the group consisting of difunctional amines selected from the group consisting of organic diamines, hydroxylamines, polyamines, poly hydroxylamines, acid amines, and mixtures thereof.

11. The synthesis of compounds comprising at least one poly functional substitution on iminodisuccinic acid having the following formula;



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P12

where X is H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal; n is 1 to 10, and R is a Lewis base capable of donating a nonbonded pair of electrons, wherein said synthesis comprises the steps of:

- 5 (a) adding an acid anhydride or lactone to a first polyfunctional amine, and allowing same to react to form a N-polyfunctional acid common name amide; and
- (b) adding water, Me(OH), and a second polyfunctional amine to said N-polyfunctional acid common name amide and allowing same to react to form an imino di N- polyfunctional acid common name amide.

10 12. The compounds synthesized in claim 11 used as fertilizer additives.

13. The compounds synthesized in claim 11 used as chelating agents in concentrations of  $1/10^a$  to 1 part, where a is less than 10, or  $1.0 \times 10^{-9}$  Molar to 3 Molar.

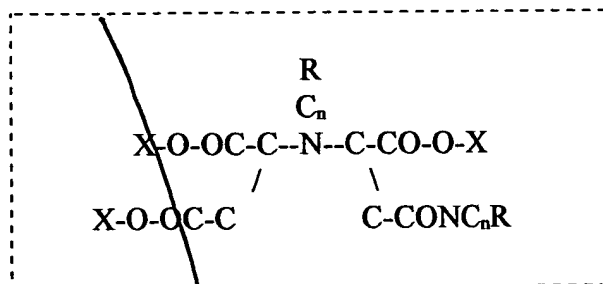
14. The compounds in claim 11 used for application to soils, seed, or plants.

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15. The synthesis of compounds comprising at least one poly functional substitution on iminodisuccinic acid having the following formula:

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gk  
b3



where X is H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal salts, n is 1 to 10, R is a lewis base capable of donating a nonbonded pair of electrons, and Me is selected from the alkali metals, wherein said synthesis comprises the steps of:

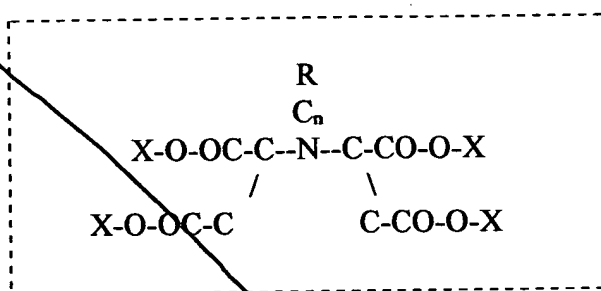
- (a) adding an acid anhydride or lactone to a first polyfunctional amine, and allowing same to react to form a N- polyfunctional acid common name amide; and
- (b) adding to said N- polyfunctional acid common name amide, water, a second polyfunctional amine, an acid anhydride or lactone, a Me (OH), and allowing same to react to form said compounds.

16. The compounds synthesized in claim 15 used as fertilizer additives.

17. The compounds synthesized in claim 15 used as chelating agents in concentrations  
20 of  $1/10^a$  to 1 part, where  $a$  is less than 10, or  $1.0 \times 10^{-9}$  Molar to 3 Molar.

18. The compounds in claim 15 used for application to soils, seed, or plants.

19. The synthesis of compounds comprising at least one poly functional substitution on iminodisuccinic acid having the following formula:



where X is H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal salts, where n is 1 to 10, where R is a Lewis base capable of donating a nonbonded pair of electrons, wherein said synthesis comprises the steps of:

adding maleic anhydride or malic acid to Me (OH) + polyfunctional amine + water, and allowing same to react to form the N, N-disuccinamicamino (functional group).

20. The compounds synthesized in claim 19 used as fertilizer additives.

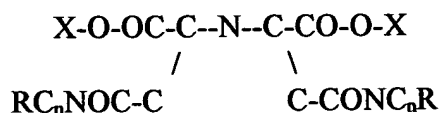
21. The compounds synthesized in claim 19 used as chelating agents in concentrations of  $1/10^9$  to 1 part, where a is less than 10, or, or  $1.0 \times 10^{-9}$  Molar to 3 Molar.

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22. The compounds in claim 19 used for application to soils, seed, or plants.

23. The synthesis of compounds comprising at least one poly functional substitution on iminodisuccinic acid having the following formula;



where X is H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal salts; where n is 1 to 10, where R is a Lewis base capable of donating a nonbonded pair of electrons; wherein said synthesis comprises the steps of:

- (a) adding acid anhydride or lactone to a first polyfunctional amine and allowing same to react to form a N- polyfunctional acid common name amide;
- (b) adding to said N- polyfunctional acid common name amide, water + ammonia + Me(OH), and allowing same to react to form an N,N- amino polyfunctional acid common name amide.

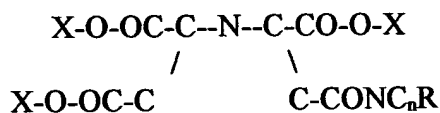
24. The compounds synthesized in claim 23 used as fertilizer additives.

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25. The compounds synthesized in claim 23 used as chelating agents in concentrations of  $1/10^a$  to 1part, where a is less then 10, or  $1.0 \times 10^{-9}$  Molar to 3Molar.

5 26. The compounds in claim 23 used for application to soils, seed, or plants.

27. The synthesis of compounds comprising at least one poly functional substitution on iminodisuccinic acid having the following formula:



10 where X may be H, alkali, alkaline earth, ammonium-substituted radical, ammonium or transition metal; where n may be 1 to 10; where R may be a lewis base capable of donating a nonbonded pair of electrons; wherein said synthesis comprises the steps of:

(a) adding an acid anhydride or lactone to a first polyfunctional amine and allowing same to react to form an N- polyfunctional acid common name amide;

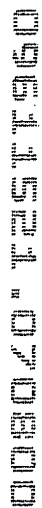
20 (b) adding to said N- polyfunctional acid common name amide, water, ammonia + maleic anhydride or maleic acid (salt) and allowing same to react to form said

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34. The iminodisuccinic acid of claim 31 used for application to soils, seed, or plants.

35. Nonphosphate fertilizer additives comprising Iminodisuccinates.

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